Constructing CoRe as a Methodological for Capturing Pedagogical Content Knowledge: A case study of Thailand Teachers Teaching Global Warming

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Abstract

This paper presents on four primary science Thailand teachers case studies which was constructing the content representation (CoRe). Their perspective and approach for constructing the CoRe could be interpreted to show the pedagogical content knowledge (PCK). This study determines how primary science teachers interpreted, used and developed their understanding of teaching global warming. The finding elucidated that their developed affluent understanding of their professional knowledge of teaching practice, class assignment and making understanding content knowledge of global warming. As a consequence, their CoRe offered a meaningful way for them to come to understand PCK and its influence on science teaching.

1. Introduction

Pedagogical content knowledge (PCK) was introduced to explain the identification of teaching knowledge. Lee Shulman (1986) described the PCK as “missing paradigm” (Shulman, 1986, p. 7). 25 years ago, it appeared to be an appealing construct to researchers, it is complexity and difficult to capturing and portraying. Also, it was shown distinct teachings’ practice of each individual participant. (Baxter & Lederman, 1999; Van Driel et al., 1998; Loughran et al., 2006). PCK, that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding (Shulman, 1987, p.8). More simply, PCK is a teachers’ knowledge how to teach subject matter knowledge in certain ways to particular students that helps the students learning. PCK has become an approach of understanding the complex relationship between pedagogy and content through an integrated process rooted in teaching practice (Van Driel et al., 1998). Recently, there is developing and examining the PCK, it was captured and portrayed through two instruments: Content Representation (CoRe); and, Pedagogical and Professional-experience Repertoires (PaP-eRs) which was devised by Loughran et al. Essentially, CoRe is an approach and tool to articulation, portrayal, and capture of science teachers’ PCK. CoRe is representation of teachers’ PCK and a sophisticated way of exploring science teachers’ knowledge about teaching specific content to particular students (Loughran et al., 2001; Kapyla et al., 2009; Hume & Berry, 2010). This paper report on a study which intend to describe in detail the PCK development of each individual

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The following research question was central to the study: How primary science teachers interpreted, used and developed their PCK through CoRe methodological of teaching the cause of global warming.

2. Method and Research Design

This section starts to describe about the participants in this inquiry and how they were selected. We then turn to an account of research instrument used in this study to examine the primary science teachers’ PCK, and description of the research procedure.

2.1. Participant and Instrument in this study

The primary science teachers who participated in this study (n=4) were in their first semester in 2011 to the first semester in 2012. They came from different schools and were collected by opportunistic sampling. They participated in work shop that is the development of science teaching approach to enhance students understanding. The researcher described a content representation and explained the method for capturing teachers’ PCK. The participants have constructing CoRe in the first time. They participated voluntarily. They have been taught general science at Udon Thani Primary Education Service Area Office 1. Also, at least they graduated bachelor degree and they have teaching experience in general science more than 20 years. Moreover, the most popular topic selected was global warming.

A Core is provided for primary science teachers who will teach a topic like global warming. It look like a blank template in table format across the top row, are the ‘Big Ideas’, which are mean to represent the major ideas and concepts. Down the left hand column are the CoRe’s questions/prompts, which are to be answered for each ‘Big Idea’. This inquiry has used questions from CoRe for pre and post interviews four primary science teachers. The main issue of question is teaching practice of global warming.

2.2 Research design and Data collection

This paper was described in the project of the development science teaching approach to enhance students understanding. There are forty primary science teachers in work shop. Four participants have included with the sixty primary science teachers. Firstly, before started the work shop, the researcher described the CoRe design for all participants and they were interviewed by CoRe questions in the first semester, 2011. Finding of interviewing is the CoRe pre-test. Secondly, they have participated in the workshop about constructing content representation. The work shop was conducted in early the first semester, 2012. The first day, there were five participants in each group, so there were eight groups. Each group had constructed four Big ideas of the Global warming which based on their freedom opinion and tried to write in to column A, B, C and D. Each group has chosen only Big idea to answer the question of CoRe. Next, they presented their work and the other discussed about CoRe. The second day, the participant constructed the Big ideas by themselves and answered the CoRe prompt. Each group has chosen a participant to present in front of the room. Four primary science teachers who participated in this study present too. Finally, after finished work shop, four primary science teachers constructed their CoRe post-test and they were interviewed about how to construct PCK, that influenced teachers’ view about the development of science teaching.

2.3 Analysis of CoRe: Learning about teaching the cause of global warming

Data were collected by using questionnaires, interview and documentation, which were analyzed by combination of documentary interpretation (Erickson, 1986) and content analysis (Miles and Huberman, 1994). Trustworthiness was shown in terms of credibility and dependability. Credibility showed aspects of triangulation-multiple methods to confirm the emerging findings, peer debriefing, and member checks-taking data. Dependability was shown in triangulation and audit trial, which were described about data collection and analysis as well as the context of study.

3. Results

There are four primary science teachers who taught the cause a topic like global warming. Next section will describe each participant in term of teachers’ background, goal and teaching practice, classroom assignment and teacher and students’ understanding subject matter knowledge.
3.1 Results of case study 1

3.1.1 Teachers’ background

Bol is a teacher, who was 54 years old. She graduated the master degree of science curriculum and she has 28 science teachers’ years. She has science teacher experience about global warming of grade 6 students. Also she works another task in her school, such as inventories officer, classroom research, and insurance quality education. Thailand’ teachers have worked more than teaching.

3.1.2 Goal and teaching practice

Ms Bol described the goal of teaching the case of global warming. Both CoRe – Pretest and CoRe- Posttest is similarly. For example, she said: To enhance the students understanding the cause of global warming, which was produced by human. If student finished learning, she believes the student can use in everyday life. In CoRe- pretest, she uses formal teaching strategy. For instance, she said: using inquiry cycle: 5Es in science teaching, because science teaching need follow step by step.

3.1.3 Classroom assignment

Ms Bol has worry about the learning environment and she said a reason: there are many students, who cannot write the answer when she asked. Also, they like wrote the data from the text book to note book. There are many students had problem of writing Thai language.

3.1.4 Teacher and students’ understanding subject matter knowledge

Ms Bol described the case of global warming: the problem of global warming produce by human being. Traditional, cultural and growing of technology influenced on global warming. She thought student should understand that the cause of global warming. In contract, there are difficulties of construct the willingness of the cause of global warming and the consequence influenced on human.

After workshop, The last point highlight Bol understanding of the CoRe emphasis. She needs plan to prepare the lesson plan and conduction to teaching. The CoRe reflect to her thinking.

3.2 Results of case study 2

3.2.1 Teachers’ background

Ket is 54 years old and she graduated in master degree of biology education. There are 28 years of experience science teachers.

3.2.2 Goal and teaching practice

She had defined the goal for teaching to enhance the students’ understanding the cause of global warming, which was produced by human being. She used the news and experimental about greenhouse production.

3.2.3 Classroom assignment

The teachers’ believes the student constructing science meaning by the teacher tell. The classroom desire the example and situations of the cause of global warming were produced by human activities.

3.2.4 Teacher and students’ understanding subject master knowledge

The teacher The students’ understanding the global warming was produce by gas greenhouse.

3.3 Result of case study 3

3.3.1 Teachers’ background

Her name is Pic. She is 47 years old and she graduated bachelor degree of teaching primary education. Also, she has science experience 25 years old.

3.3.2 She defined the goal of teaching to enhance the students’ understanding the cause of global warming, which was produced by human and believes that the formal teaching strategy (science teaching is step by step). After workshop she said that sometime science teaching should use the news and experimental.

3.3.3 Classroom assignment

Teaching is not focus on telling but it focus on examining students act and how to learn.

3.3.4 Teacher and students’ understanding subject master knowledge

The students tell about the climate change and the dissolution of poles of the earth ice it’s still comes to don’t arrive at our house.
3.4 Result of case study 4
3.4.1 Teachers’ background: Rean is 49 years old and he graduated bachelor degree of science education.
3.4.2 Goal and teaching practice: Rean defined the definition of global warming.
3.4.3 Classroom assignment: The teacher should use situation in everyday life connect to science learning.
3.4.4 Teacher and students’ understanding subject master knowledge: The consequence of global warming influenced on the world. May be it do not affect on the student in overflow.

Table 1. CoRe for Ms Bol, Ms Ket, Ms Pic and Mr Reang’s instruction on the cause of global warming

<table>
<thead>
<tr>
<th>Big ideas</th>
<th>CoRe 1</th>
<th>CoRe 2</th>
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<tbody>
<tr>
<td>1. What do you intend the students to learn about this idea?</td>
<td>To enhance the student understanding the cause of global warming (B&amp;R). The problem of global warming (K). To enhance students’ understanding the produce of CO₂ (P).</td>
<td>To enhance the students’ understanding the cause of global warming, which was produced by human (B, P &amp;K). The definition of Global warming and inquiry the cause of global warming (R).</td>
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<tr>
<td>2. Why it is important for students to know this?</td>
<td>To protection or reduction global warming (B). Using for everyday life (K). Reduction CO₂ to reduce global warming (P). Finding approach for reduction (R).</td>
<td>Using for everyday life (B&amp;K). Climate change is the knowledge that the students should know (P). Relate to nowadays of global warming such as green house gases, motor combustion and burning forest (R).</td>
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<tr>
<td>3. What else do you know about this idea (that you do not intend students to know yet)?</td>
<td>The consequence of global warming (B, R &amp;K). The process of production CO₂ (P).</td>
<td>Climate change of solar system (B). Aniyo Laniya effect (K). Greenhouse effect and acid rain (P). Ozone layer and acid rain (R).</td>
</tr>
<tr>
<td>4. What are the difficulties/limitations connected with teaching this ideas?</td>
<td>The parents’ action in community (B). Lacking the way of protection (K). The students believed that they were not get the consequence of global warming (P). Lacking activities in learning (R).</td>
<td>Constructing the willingness of the cause of global warming and the consequence influenced on human (B&amp;R). Poor climate change background (P). Poor the example and situations of the cause of global warming were produced by human activities (K).</td>
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<td>5. What is your knowledge about students’ thinking, which influences your teaching of this idea?</td>
<td>The problem of global warming (B). Conservation of natural resources (P). The situation in everyday life (K&amp;R).</td>
<td>The parents and students in community do not attractive the global warming problem (B). Learners’ view of the global warming and greenhouse gases reduction activities (K). Learners tell about the climate change and the dissolution of poles of the earth ice it’s still comes to don't arrive at our house (P). The consequence of global warming influenced on the world. May be it do not affect on the student in overflow (R).</td>
</tr>
<tr>
<td>6. Are there any other factors that influence your teaching of these ideas?</td>
<td>The time of teaching and learning (B). The parents were sponsor (K). Prior knowledge of gas’ property (P). The parents’ action in community such as burning forest, charcoal burning(R).</td>
<td>Traditional, cultural and growing of technology (B). Teacher lakes subject matter knowledge and questioning (K). Poor climate change background and misconception about charcoal burning (P). Poor teaching approach (R).</td>
</tr>
<tr>
<td>7. What are your teaching procedures (and particular reasons for using these to engage with this idea)?</td>
<td>Using inquiry cycle: 5Es (B,K&amp;P) Discussion about the situation and news of global warming (R).</td>
<td>Using the movie and Clip VDO on internet (B). News analysis and experimental of CO₂ process (K&amp;P). Using actually situation in everyday life such as sitting in the car, lying down in cloth bag. After that analogy between outside and inside of the car (R).</td>
</tr>
<tr>
<td>8. Specific ways for ascertaining students’ understanding or confusion around this idea (Include likely range of responses).</td>
<td>multiple choice achievement test (B,P&amp;R). Using the questionnaires rating scale and questioning (K).</td>
<td>Open-end questionnaires, concept mapping and multiple choice test (B&amp;P). Writing the short answer, interviews and science project (K). Observation and document analysis of the result of experimental(R).</td>
</tr>
</tbody>
</table>

Notes: B, Ms Bol; K, Ms Ket; P, Ms Pic; R, Mr Reang.
3. Discussion and Conclusion

In many aspects, the CoRe post-test of the four primary science teachers show similarities. The aims of teaching global warming emphasis on knowing definitions of the cause of global warming and being able to understanding. There is also making understanding of the specific ways for ascertaining students' understanding which is authentic assessment. In the other hand, there are noticeable differences in aspects’ PCK such as knowing of the curriculum, making the students’ conception, and teaching approach. The three aspects’ PCK of CoRe post-test differed CoRe pre-test. In CoRe post-test, Ms Ket and Ms Pic identifies conceptual issues with regard to the importance of the teaching approach and her consideration of the teaching practice which have used the news analysis and experimental of CO₂ process. The situation in the news were occurred in the local area that is significant on socio-cultural. Flooding may occur in local area. Also, Ms Bol, she focused on medial instructional assignment which has engaged the student learning related to the difficulties or limitations connected with teaching. They said that “The VDO help to enhance the willingness of the production global warming and easy make students ‘understanding of the cause of global warming’. Although, the participants understanding of teaching approach, knowing of the curriculum, and the knowledge of the students’ conception have had problematic. There were considered the factors that influence their teaching in width such as traditional, cultural and growing of technology and poor teaching approach. However, the students’ degree of willingness to act and the conception of the cause of global warming were did not considered. The primary science teachers should develop their misconception regarding local environmental issues (Groves & Pugh, 1999; Hamilton et al., 2009).

The finding of the primary science teachers’ view of using PCK have improved in aspects of teaching practice, class assignment (it means conduction of media instructional and teaching approach), and making understanding subject matter. They changed CoRe pre-test to CoRe post test. However, the teachers’ professional development should consider the process and approach for examining the teacher and students’ misconceptions. Future research needs to constructing the CoRe which best promote or solve misconception of the cause of global warming.

Acknowledgements

The author would like to thank you the Institute for the promotion of Science Teaching and Technology (IPST) where is scholarships’ sponsor for this inquiry.

References


